DOCUMENT RESUME

ED 063 508 VT 015 717

TITLE	Denmark--The Education, Training and Functions of Technicians. Scientific and Technical Personnel.
INSTITUTION	Organisation for Economic Cooperation and Development, Paris (France). Directorate for Scientific Affairs.
PUB DATE	Mar 67
NOTE	88p.
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	Articulation (Program); Economic Development; *Foreign Countries; Job Analysis; *Job Training; Manpower Development; *Manpower Utilization; *National Surveys; Tables (Data); Teacher Education; *Technical Education; Vocational Education

ABSTRACT

To identify problems regarding economic development, the Committee for Scientific and Technical Personnel conducted an educational and occupational survey of each member country of the Organization for Economic Cooperation and Development (OECD). The specific purpose of the surveys was to gather comparative data on the training and utilization of technicians in each member country. Major sections of each survey are: (1) The Structure of the Educational System, (2) Training of Technicians and Other Technical Manpower, and (3) Functions of Technicians. Related surveys for each of the following countries, Canada, Spain, France, Netherlands, Switzerland, Yugoslavia, United Kingdom, Portugal, and Italy, are available in this issue as VT 015 716, VT 015 718-VT 015 725 respectively. (JS)

ED 063508

DOCUMENT

OCDE
OECD

SCIENTIFIC AND TECHNICAL PERSONNEL

THE EDUCATION, TRAINING AND FUNCTIONS OF TECHNICIANS

DENMARK

VT015717

DIRECTORATE FOR SCIENTIFIC AFFAIRS

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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SCIENTIFIC AND TECHNICAL PERSONNEL

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THE EDUCATION, TRAINING AND FUNCTIONS OF TECHNICIANS

DENMARK

DIRECTORATE FOR SCIENTIFIC AFFAIRS

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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PREFACE

The Ministry of Education greatly appreciates the initiative taken by the OECD in arranging confrontation meetings so that relevant comparisons may be made with a view to examine statements worked out according to common directives.

These meetings are similar to the confrontation meetings dealing with the economy of the Member countries and which have already proved their worth.

For some years all Member countries have been modernizing their technical education. In Denmark, reforms and a thorough administrative reorganisation have been carried through and new legal provisions, rules and regulations for State grants to this section of education have been enacted.

Through these extensive reforms cooperation between labour market organisations and professional associations have been deepened and extended.

K.B. Anderson
Minister of Education

INTRODUCTION

The OECD Committee for Scientific and Technical Personnel has given considerable attention to the technician problem as a key issue in the economic development of Member countries and has on several occasions drawn attention to the need for an adequate supply of and proper training for skills at this level.

In order to clarify the situation as far as possible and to establish a solid base for discussion, the Committee has instituted a series of surveys in Member countries describing and analysing training conditions.

The material obtained is classified according to a standard pattern throughout, so that comparisons can be drawn between countries. The completed surveys are used as basic working documents for "Confrontation Meetings" between two or more countries. These meetings, are held under a neutral chairman, and are attended by teams of specialists from the participating countries. Delegates discuss each other's training systems and the various problems which arise and try to reach conclusions on questions of policy and to find solutions to technical difficulties.

The present publication, the third of a series, is a revised version of the working document used at the confrontation meeting between the Netherlands, Spain, Switzerland and Yugoslavia, held in Paris in December, 1965. The conclusions of this meeting as well as of the previous one between Canada and Denmark, are given in Appendix XII.

The report was prepared by the OECD Secretariat, and the responsibility for it has been with Mr. S. Syrimis, Consultant to the Directorate for Scientific Affairs. It incorporates information

already available at OECD, especially in the original survey carried out by a joint FEANI/EUSEC(1) Committee, supplemented by on-the-spot investigation.

Acknowledgement is made to the Danish Educational Authorities for their help and co-operation in the preparation of this report.

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(1) European Federation of National Associations of Engineers (FEANI) Conference of Engineering societies of Western Europe and the United States of America (EUSEC).

Part One

THE STRUCTURE OF THE EDUCATIONAL SYSTEM

I. GENERAL DATA - THE PLACE OF TECHNICAL EDUCATION IN THE EDUCATIONAL SYSTEM

1. In general, education in Denmark has been centrally controlled by the Ministry of Education since autumn 1961, although some branches still remain under other ministries.

2. Primary education corresponds to the period of compulsory education, which is seven years at present, and covers the seven-to-fourteen age group. The great majority of children receive their primary education in State schools, known as folkeskoler. In the 6th and 7th grades the basic primary course is differentiated to somme extent as regards the teaching of English, German and mathematics, while in bigger schools the course is divided into "academic" and "ordinary" branches. "Streaming" of children at this stage is based on parents' wishes and school assessment.

3. Secondary education, originally introduced by the Church, was developed independently of primary education up to the 20th century, when several Acts and Decrees (1903, 1937, 1958) led to a thorough

integration of the two currents, mainly by the introduction of an intermediate course (Real), the postponing of final "streaming" by four years (fifteen plus, instead of eleven plus) and several other structural and administrative provisions.

4. Technical education was introduced rather late in Denmark. Prior to 1900, there was a general prejudice against manufacturing due mainly to the strong position of agriculture and the conviction that industrialisation would lead to social distress.

5. Technical education and training were developed outside the formal educational system under the jurisdiction of the Ministry of Commerce and Industry. The 1958 Educational Reform Act on secondary education provided, for the first time, for close collaboration between general and technical secondary education, the latter being finally transferred to the Ministry of Education (1961). This facilitated collaboration between the two branches and, on the basis of the report of a special 'Technical Commission' (1959) provision was made for a considerable degree of integration which is expected to develop further in the near future.

6. The system of lower and upper secondary education now in force is as follows:

(a) Lower secondary (general) education (Réalafdelingen)

This lasts three years and follows the seventh year (last year of compulsory education) of the primary school (Hovedskolen). The third year of this lower secondary school has two lines: ordinary and technical, with a pronounced technical bias, special emphasis being placed on mathematics and physics, but without any practical technical training. The Lower Secondary School Certificate, ordinary or technical, (Realeksamen or Teknisk Realeksamen) is granted to students who pass the examination.
In forms 8, 9, and 10 of the State schools provisions are made for streaming, one division offering education with a technical bias leading to a State-controlled Preparatory Technical Examination (Teknisk Forberedelseseksamen).

(b) Upper secondary (general) education (Gymnasium)

Upper secondary general education also lasts three years and follows the second year of the "Réalafdeling" (10th, 11th and 12th year of school). The "Gymnasium" is divided into 2 lines, each of which is split up into three branches as follows:

Languages:	Modern Languages;
	Civics;
	Classical Languages.
Mathematics:	Mathematics - Physics;
	Civics;
	Natural Science.

(Students passing the examination in any of these branches are awarded the Upper Secondary School-Leaving Certificate (Studentereksamensbevis).

(c) Technical and vocational education

Secondary technical and vocational education includes the following:

(i) A two-year preparatory technical course following seven years of primary school, leading to the Preparatory Technical Examination I (Teknisk Forberedelseseksamen), T 1. This course does not include practical training and is no more than an introduction to the technical courses proper;

(ii) Preparatory Technical Examination II (Udvidet Teknisk Forberedelseseksamen). Students in the 10th form of the "folkeskole", the youth school, technical preparatory courses or other schools or courses duly recognized by the Ministry of Education, may sit for this examination after having taken Preparatory Technical Examination I or its equivalent;

(iii) Apprenticeship training in workshop or industry combined with a course at a technical college for artisans and craftsmen this constitutes a basis for further technical training;

(iv) Several courses for which the entrance requirements, duration and structure, vary according to the trade. These prepare the trainees to be lower-level technicians;

(v) Three-year courses for students within the age range 21-24 years leading to examinations for the different types of teknikum engineering (see paragraph 15).

Technical and vocational courses are described in detail, under the appropriate headings in the text, while the diagram in Appendix I (page 63) illustrates in a simplified form the structure of technical education within the framework of the educational system as a whole.

(d) Higher education

Higher Education is provided at:

The University of Copenhagen;

The University of Aarhus, (Theology, Law, Economics, Arts, Medicine and the Sciences);

The Technical University of Denmark;

The Academy of Engineers (Technical faculties) and other Institutes of Higher Education;

A third University, located in Odense, founded in September 1966.

The Upper Secondary School-Leaving Examination Certificate (Studentereksamensbevis) qualifies holders for admission to most faculties at university level, the normal duration of secondary education being from 4 to 7 years.

II. EDUCATIONAL AND VOCATIONAL ORIENTATION AND GUIDANCE

7. Educational orientation and guidance is offered as a service to pupils at the time of their promotion or transfer to different lines of education. The headmaster of the school, the child's teacher, the school medical officer, the school psychologist and other experts who are appointed if necessary, all take part. Vocational guidance is now

organized as a regular school service in the different types of secondary school through the Ministry of Labour and its vocational guidance officers and the regional State employment offices throughout the country.

8. The Council of Vocational Guidance, the head of which is the Secretary of State to the Ministry of Labour, advises the Ministers of Labour and Education on matters pertaining to such guidance. The heads of the Ministry of Education Directorates, and representatives of trade, industry and labour organisations are members of this council.

9. Since 1961, special short courses for teachers who are interested have been arranged by the Ministry of Education. More than 5,000 teachers have so far attended these courses; specialists from the Ministry of Labour act as instructors.

Vocational Guidance is now included in the curriculum of grades 7 - 10 of the lower secondary school; it includes classroom instruction visits to commercial firms and industries, and practical work in industry or in institutes for periods of 2-3 weeks.

10. Practical subjects integrated into school curricula contribute towards educational orientation. In the primary school, training in practical subjects is provided in the workshop (woodwork and metal work) to the extent of two periods of instruction per week in the sixth and seventh forms. In the eighth and ninth forms of the lower secondary schools, commercial and handicraft subjects are introduced for those who are leaving school at the age of 16. At this stage, instruction increases to eight periods a week and pupils have an opportunity to practise their chosen fields of work, which is given a distinct vocational bias.

11. Home Economics is compulsory for girls in the 6th and 7th forms of the primary school. In the secondary school they may choose a "domestic line" with 320 periods of instruction in the 8th and 9th forms, and 160 periods in the 10th form. Needle-work is usually begun in the second year of primary school, and is compulsory up to the age of 14, but optional in the 8th, 9th and 10th forms.

III. AUTHORITIES IN CHARGE OF EDUCATION - CO-ORDINATING AND PLANNING MECHANISMS

(a) Ministry of Education

12. The Ministry of Education, which has been responsible for most branches of education since 1961, has been undergoing a major reorganisation for the past few years. During the first stage (Appendix II,A) three directorates were set up under the department of Primary and Secondary Education, as follows: one for primary schools, lower secondary schools and teacher-training colleges; one for upper secondary schools; and one for Folk High Schools (paragraph 57i), home economics schools, continuation schools, youth schools, and evening courses. In the second stage, (Appendix II,B) the "Interim" Department of Technical and Vocational Education was abolished, and the Directorate of Technical, Commercial and Marine Engineer/Education, established. The third stage combined Department I and Department II into one Main Department headed by a permanent Under-Secretary of State. (Appendix II, C)

(b) Advisory and co-ordinating bodies

13. The following bodies advise and assist the educational authorities concerned with technical and vocational education and training:

(i) Technical Schools' Council

This is composed of representatives of technical education, industry, and the trade unions, and until the administrative reorganisation in 1965 (paragraph 12), was headed by the Director of Technical and Vocational Education. Since 24th May 1965, the new Director of Technical, Commercial, and Marine Engineering Education has been chairman of the Technical Schools' Council. The Council's terms of reference are to advise the Minister, through the appropriate authorities, on matters relating to the technical schools, i.e. the training of lower technicians and apprentices. The Council cooperates with the Apprenticeship Board (iii, below) and has close contacts,

through the appropriate directorate, with the Advisory Trade Committees (paragraph 18).

(ii) Council for the Education of Assistants in Commerce and Offices

This body was similar in composition to the Technical Schools' Council until new legislation was passed in the spring of 1965. By the Act of May 26, 1965 the new Council consists of a chairman appointed by the Minister of Education, and of representatives of industrial and commercial organisations and the labour unions, the trade committees and the associations of teachers and principals of the commercial schools. Its functions are parallel to those of the Technical Schools' Council, i.e. to advise the Minister, through the appropriate authorities, on matters relating to commercial schools (lower commercial education).

(iii) Apprenticeship Board

The Apprenticeship Board deals in an advisory capacity with matters relating to the industrial side of apprenticeship and handicrafts. The Board is composed of representatives of the Ministry of Education (2), the Ministry of Labour (2), the employers' association (7) and the trade unions (7). The chairman of the Council is appointed by the King.
Thirty-one Joint Trade Committees (paragraph 46) assist the Board in its work.

(iv) "Teknikum" Education Council

This Council was set up in 1962, and is composed of representatives of the Ministry of Education (3), the technical colleges or "Teknika" (3 Rectors), the Technical University of Denmark (3), the Society of Engineers (Teknikum level) (3), the Federation of Danish Industries (3) and the trade unions (3). It is headed by the Director of Technical, Commercial and Marine Engineering Education who is responsible for technical educution. Its terms of reference are to advise the Minister on matters relating to education at teknikum engineering level.

(c) The planning procedure

14. No special planning unit as such exists within the Ministry of Education although the establishment in recent years of an "Economics and Statistics Advisory Unit" and the "Planning Board for Higher Education" provides useful elements for planning.

Part Two

TRAINING OF TECHNICIANS AND OTHER TECHNICAL MANPOWER

IV. DEFINITION AND GRADING OF THE TECHNICIAN

- STANDARDISED QUALIFICATIONS -

15. In Denmark no official definition of the term technician exists. However, judging from the curricula of the various technical courses authorised by the government, and the terms used, it may be assumed that the terms "technical assistant", "technician", and "teknikum engineer" are used to define technical manpower ranging from the skilled worker to the university-trained engineer and which, according to agreement reached at the OECD confrontation meetings on technician training and utilisation, correspond to "technician force" "technical assistants" and "technicians" and may be classified as "lower-level technicians", and "teknikum engineers" as "non-university engineers".

16. Qualifications have been fairly well standardised and there is a considerable degree of uniformity, especially at the lower level, as shown by the following data.

(a) Content of courses

17. The content of lower-level technician courses is uniform throughout the country. For each such course, the governement promulgates a special Authorisation Act covering the following points : (i) nature and purpose of the course; (ii) types of schools authorised to run the course; (iii) admission requirements; (iv) duration; (v) time-table; (vi) curriculum outline; (vii) final examination regulations; (viii) appointment of a special "Advisory Committee for the Trade"; (ix) provision for the formation of a "Local Advisory Committee" for each school authorised to hold the course.

In Appendix III (page 49) the English translation of such an Authorisation Act is given as an example.

18. The time-table and the syllabuses for each course are prepared by the Ministry of Education in consultation with industry, the trade unions and the technical schools, but may be revised according to the suggestions of the "Advisory Committee for the Trade" which usually consists of specialists in the Trade, representatives of industry, the trade unions and the technicians' associations. Officials from the Ministry of Education are present as observers at the Committee's meetings.

Some courses are still arranged by the schools in cooperation with industry, but all should have the approval of the Ministry of Education.

19. The syllabuses for technician courses are prepared by the educational authorities through specially authorised commissions appointed for the purpose.

(b) Final examinations

20. The final examinations for lower-level technician courses and some teknikum engineering courses (civil engineering and ship-building) are the same for all the courses. The papers are set by the "Examination Commission for Technical Education", a permanent commission under the Ministry of Education (Appendix II), in consultation with specialists from education departments and industry.

(c) Certificates and diplomas

21. All certificates (for lower-level technicians) and diplomas (for teknikum engineers) are uniform and are issued by the schools or colleges and approved by the Ministry of Education. The date and type of the final examination passed should be quoted on the diploma/certificate.

V. LOWER-LEVEL TECHNICIAN COURSES WITHIN THE FORMAL EDUCATIONAL SYSTEM

22. Lower-level technician courses are given by the "technical schools" mostly in combination with apprenticeship courses. These schools are under direct governmental control and are closely supervised by representatives of the Ministry of Education.

23. The following 17 lower-level technician courses are available at present:

> Laboratory assistant, laboratory technician, technician in chemical industry, technical assistant (calculator, draughtsman, assistant in the engineering industry), technician in electronics, technician in mechanical industry, building technician, building constructor, furniture constructor, gold and silver-ware designer, dress designer, textile (weaving and printing) technician, technician in the ceramics industry, technician in commercial advertising, technician in the clothing industry, textile technician and interior decorator. Special arrangements are also available for the training of assistant marine-engineers.

24. Although admission requirements, duration, and structure of the lower-level technician courses vary considerably, their main characteristics may be summarised as follows:

(i) Educational background required for most of the courses is a minimum of nine years basic education, special reference is made to preparatory technical examination certificates for certain courses.

As an alternative, for some courses the basic education required may be reduced to 7 years if supplemented by preparatory courses of 3 to 6 months' duration. In certain cases special entrance examinations may be required instead;

(ii) The duration of the actual courses varies considerably (6 months to 4 years), the curriculum is theoretical (with the exception of the sandwich courses) and includes, apart from the technological subjects (mathematics, technical science, technical drawing, book-keeping, and the theory of the trade) Danish and, in certain cases, English and/or German;

(iii) Training for lower-level technicians caters for a wide range in ages (16 to 23);

(iv) There are no statistical data available as regards wastage (drop-outs) in the courses, but it appears to be negligible. For further analysis and examples of time-tables, see Appendix IV.

VI. TEKNIKUM ENGINEERING COURSES WITHIN THE FORMAL EDUCATIONAL SYSTEM

25. Teknikum engineering courses are held by the technical colleges or "Teknika" which are institutions administered by local independent bodies consisting of representatives of local industry, labour unions, municipal authorities, the State, and the principal of the college (Rector). The "Teknika" are supported financially by the Government, although governmental supervision and control, as regards their educational functions, are limited.

All technical colleges are adequately equipped to meet requirements for training Teknikum engineers.

26. Teknikum engineering courses at present cover the following fields:

(i) Mechanical engineering;
(ii) production engineering;

(iii) electrical engineering, low voltage;
(iv) electrical engineering, high voltage;
(v) shipbuilding engineering;
(vi) civil engineering, construction;
(vii) civil engineering, public works.

27. The main characteristics of the Teknikum engineering courses may be summarised as follows:

(i) All courses are of three years' duration, apprenticeship being the main source of recruitment;

(ii) Educational background required is a Preparatory Technical Examination certificate (nine years of education) supplemented by a three months' preparatory course prior to the course proper, or a "Real" examination certificate (ten years of education) with direct entry to the course proper;

(iii) The practical experience required is three to four years acquired through apprenticeship;

(iv) The curricula for the courses are mainly theoretical, with Danish and foreign languages (English and German) not exceeding seven or nine per cent of the total period of instruction. Accounting, law and management principles are also included in the curriculum.

Examples of time-tables are given in Appendix V, while the syllabuses of the mechanical and electrical engineering courses, together with a further analysis concerning regulations for admission, examinations, etc. are available in a separate OECD document (DAS/EID/65.34, Addendum).

28. The whole programme of training for Teknikum engineers is revision, and major changes may be expected in the near future.

According to the plan under consideration, admission requirements in science subjects will be revised and the practical training required for admission will be reduced to 2 1/2 years, the first of which will be spent in a school workshop. Those who have obtained the "Real" examination certificate in technical subjects, or mathematics and sciences, or an advanced (T2) Preparatory Technical Examination Certificate (one year

in addition to the existing Preparatory Technical Course, T1), will be admitted to the actual course after a preparatory year.
The diagram in Appendix VI (page 80) shows present and proposed structures.

VII. VOCATIONAL COURSES AT CRAFTSMAN LEVEL WITHIN THE FORMAL EDUCATIONAL SYSTEM

29. Vocational training at craftsman level is obtained only through apprenticeship. Although apprenticeship training in Denmark might be considered as part of the formal educational system, with a view to obtaining uniformity and easy comparison with other countries, it will be examined under the chapter "Training outside the formal system".

VIII. TECHNICAL COURSES AT UNIVERSITY LEVEL

30. Technical education at university level comprises two types of courses, namely the "Civil" (1) engineering courses and the "Academy" engineering courses.

31. "Civil engineers" are trained at the Danish Technical University (D.T.H. Danmarks Tekniske Højskole) founded in 1829. The training is at a high theoretical level and lasts 4 to 5 1/2 years, depending on the line of specialisation. Ninety per cent of the students in D.T.H. are from the mathematics-science line of the "gymnasium". Either a "Studenter" certificate, the marks for mathematics and sciences being above a certain minimum, or the passing of an entrance examination is required

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(1) The term "Civil" is used here in the Scandinavian sense, i.e. it denotes the fundamental type of training provided for engineers.

for admission. Candidates from the "Teknika" who have passed the "Real" examination plus a test in biology and physiology are also admitted.

32. At present the following main fields of study are covered by D.T.H.: Mechanical engineering, electrical engineering, building and construction engineering, chemical engineering. Further specialisation is now possible during the three final years of the course, for example, shipbuilding engineering branches off from mechanical engineering; ceramics, metallurgy, or bio-technics from chemical engineering.
Since 1953, a post-graduate course leading to a doctorate exists, and is taken by two or three persons each year.

33. "Academy engineers" are trained at the "Academy of Engineers", the director (Rector) of which is also director of D.T.H. The courses were introduced in 1957 as a result of a request from the Society of Engineers for shorter courses at university level. Constructional, electrical and chemical engineering courses last 3 1/2 years, including six months of practical work, and the mechanical engineering courses last four years, including one year's practical work. "Academy" courses have a pronounced practical bias. Admission requirements correspond to those in force for admission to "Civil" engineering courses (paragraph 31).

IX. TECHNICAL TEACHING STAFF

(a) Recruitment and training

34. The main source of recruitment for teachers of technological subjects and workshop instructors is the technician force. Technical teachers may be classified, according to their qualifications, into three categories:

(i) Highly skilled workers (craftsmen or lower-level technicians) with several years of industrial experience, plus teaching experience in evening classes;

(ii) Teknikum engineers;

(iii) University engineers.

35. It is evident that in all three cases, however, the weak point is the professional-pedagogic side. The Ministry of Education, through its special division called the "National Institute for Education of Technical Teachers", established as early as 1916, deals with this problem. The staff of the Division includes nine "course leaders". Courses are arranged for teachers at technical and vocational schools and colleges. The type and content of these courses are summarised below:

(i) Basic teaching course:

36. This course is at a residential school, lasts 14 weeks and leads to a certificate. The curriculum includes pedagogical principles, psychology, teaching techniques, the production and use of visual aids, etc. as well as four weeks of actual teaching practice in technical schools under guidance and supervision.

37. As an alternative to this course special arrangements have been made for teachers who cannot stay away from their schools for 14 consecutive weeks. A course has been arranged in six separate sessions of one week each followed by a three-week final session. The practical work is carried out, between sessions, in the schools where the teachers are appointed. Expenses for all courses are met by the Government.

(ii) Higher pedagogical courses:

38. The higher courses cover several educational branches to an advanced level (they follow the basic course) and are residential courses of one week's duration.

(iii) Trade courses:

39. Trade courses are designed mainly for teachers of vocational schools and deal with special teaching techniques and new developments within the trade. As curricula are revised every year the courses may be attended

by the same teacher for a number of years. Teachers of metalwork are obliged to take a trade course each year combined with a pedagogical course ((ii) above). Courses last one week and are residential.

(iv) Annual conferences and seminars for school directors:

40. These mainly concern educational policy, administrative matters of general interest and school management problems, they take place in technical schools or other premises which may be available (hotels, inns, etc.). The "course leaders" of the special division of the Ministry of Education (paragraph 35) as well as specialists from other educational institutions and industry, act as instructors and lecturers.

(b) Status and salaries

41. The salaries of technical teachers depend on their qualifications and the type of school in which they teach; technical schools are usually staffed by teachers having "craftsman" or lower-level technician background, while the "teknika" are staffed by Teknikum engineers (approximately 80 per cent) or University engineers (approximately 20 per cent).

42. The approximate annual emoluments (bottom and top scales) for the different grades of technical teacher are shown in Table 1. The salaries given in the table, however, include a 16 per cent increase paid by the government for five hours of "compulsory overtime teaching".

43. The salary scales for technical teachers are fixed by agreements between the government and the respective professional associations and are uniform, with the exception of the "compulsory overtime" throughout the civil service. In private industry, however, technical personnel is better paid.

Table 1

Teacher Salaries (in Danish Crowns (1) per year)

	Starting salary per year	Top scale	Number of years required to reach top-scale
1. Teachers at technical schools	29,500	43,900	30
2. Teachers at "Teknika" with:			
(a) Teknikum engineering qualifications	30,000	48,000	20
(b) "Civil" engineering degree	31,800	56,300	20
(c) Degrees in other fields	32,500	50,500	27

(1) 6.80 Danish Crowns = 1 U.S.A. dollar.

X. TRAINING OUTSIDE THE FORMAL SYSTEM

(a) Apprenticeship

44. Apprenticeship in Denmark is the only form of craftsman training and at the same timeis the basis of technician training. The first Apprenticeship Act was passed as early as 1889; the current regulations are contained in the Act of October 2nd, 1956, on "Apprenticeship Conditions".The scheme, formerly under the joint jurisdiction of the Ministry of Labour and the Ministry of Commerce and Industry, was transferred,

together with the entire field of Technical Education, to the Ministry of Education in September 1961.

45. The Ministry is assisted in its functions concerning apprenticeship by the "Apprenticeship Board" (para. 13, iii) and the Joint Trade Committees (one for each trade or group of similar trades). The Committes are composed of an equal number of members from Employers and Labour specialists in the trade. Their main function consists in fixing the normal apprenticeship training period for the trade (varying from 2 to 4 years according to the trade), in setting standards for practical training in the "master's" shop and in formulating specifications for the final examinations for the Craftsman's Certificate at the end of the apprenticeship period; the formal approval of the Apprenticeship Board is required. Thirty-one such committees for approximately 150 different courses exist.

46. Apprenticeship may start at the age of 14, after seven years of compulsory education, but the number of those entering after eight years of schooling or after obtaining the Preparatory Technical examination certificate (nine years) or the "Real" examination certificate (ten years) is constantly increasing from year to year.

47. Apprentices are articled to "masters" in handicrafts or to industrial firms. Wages and the obligations and responsibilities of the "master" and the apprentice are contained in a special contract signed by the "master" and the apprentice's guardian (in case the apprentice is under 18 years of age).

48. Apprentices are released, on full pay, for certain periods each year of their apprenticeship to attend a technical school. The length of such periods varies from three to twelve weeks of full-time day-school attendance, according to the trade. The school training programme is prepared by the Ministry of Education in consultation with the Apprenticeship Board and the Technical Schools Council (paragraph 13).

49. Prior to 1956, technical school training was carried out in evening classes. However, the Reform Act of 1956 provided, inter-alia, that such training should take place in full-time day-schools and that this transition from evening to day courses should be completed not later than December 1964. These reforms, and centralisation providing for residential

facilities, have led to a decrease in the number of technical schools from 350 in 1956, to 120 in 1962, and 90 in 1964.

(b) Courses under other Ministries

50. The Ministry of Labour organises several courses for training unskilled labour up to the semi-skilled level. A variety of fields is covered and the courses are open to all employed and unemployed adults (over 18). Eight residential schools and fifteen private state-aided day schools carry out this training programme, laid down by the Act of 18th May, 1960 and administered by a special Council for the Training of Unskilled Labour, under the Ministry of Labour.

51. The Ministry of Commerce and Industry is responsible for supervising courses directly connected with the training of skilled workers and lower-level technicians. Such courses are administered by the Technological Institutes, whose main objectives are: (a) To organise and hold short courses for skilled workers to permit further specialisation in certain fields of their trade or promotion to supervisory posts, (b) to carry out research or routine tests for industry. Two of these institutes (out of a total of five) hold technician courses for laboratory assistants, laboratory technicians, and technicians for the chemical industry.

52. The Technological Institutes are independent, state-aided institutions under the supervision of the Council of Technological Institutes, a joint board composed of representatives of employers, employees and the Ministries of commerce and Industry, Education, and Labour, and responsible to the Ministry of Commerce and Industry.

(c) Courses held by non-governmental organisations

53. Several courses are held by non-governmental organisations but the majority of them have no direct connection with actual technician training. Some of them, however, are designed to help technicians obtain promotion to supervisory posts, or to equip them with additional knowledge in specific industrial fields. A brief description of the courses at present available is given below:

54. The Federation of Danish Industries, an association of industrial firms covering 60 different branches of industry, arranges courses in (a) management, (b) supervision, (c) special industrial techniques (quality control, production control, accounting and budgeting, etc.). Courses under (b) and (c) are mainly attended by technicians in several industrial fields.

The training department of the Federation is staffed with 22 permanent consultants but also makes use of part-time specialists from industry and education. It is estimated that an average of 5,000 trainees attend these courses each year.

55. The Employers' Confederation, through its training department and the department of Educational Policy, holds courses on management and supervision similar to those held by the Federation of Danish Industries. The Confederation, which is actively interested in linking the schools (especially technical) with industry, is represented on several educational councils and advisory committees; it consists of 300 individual companies and 250 company-groups.

56. The Congress of Trade Unions organises and holds courses to help skilled workers to be upgraded through further specialisation in specific technical fields. Special emphasis is now given to welding but more trades are under consideration.
The Congress is composed of 21 different trade unions, i.e. one for women, one for unskilled labourers and nineteen for skilled workers classified according to trade.

(d) Adult education - special schools

57. Adult education in Denmark does not cover actual vocational and technical fields although some courses (in youth schools, etc.) may be considered as preparatory to technician training. The scheme is under the jurisdiction of the Ministry of Education. A brief description of the facilities available in this field is given below:

(i) Folk High Schools are independent institutions receiving State grants and attended by the 18 to 25-plus age groups. Their syllabuses usually include Danish, mathematics, history, literature, civics, foreign languages and psychology.

(ii) Continuation Schools are private, state-aided residential institutions attended by the 14 - 18 age group. They are a kind of Folk High School for younger persons, but with greater emphasis on elementary school and practical subjects.

(iii) Youth Schools are government schools of various types for the 14 - 18 age group; their main objective is to "educate and equip youth for the economic and social aspects of life and to help give greater meaning and substance to their adolescent life and leisure". A special type of youth school provides day and evening courses similar to those in Preparatory Technical classes and terminating with the same examinations (T1, preparatory for technician education); these are attended mainly by young persons with seven years of compulsory education. Fifty such schools exist at present, attended by approximately 1,000 students, although not more than 50 per cent complete the course and take the final examination (T1).

(iv) Evening classes, mainly in cultural and social subjects, are available throughout the country.

(v) The University Extension Committee co-operates with educational associations throughout the country in spreading academic education, including the communication of the results of modern research, as widely as possible.

(e) Correspondence courses

58. In Denmark, although up to now correspondence courses have made very little contribution to technical and vocational education, legislative provisions have been made for their development in recent years. Experimental technician courses (Technical Assistants) have been introduced for the benefit of personnel serving in the armed forces on three- to five-year contracts, but the number of students taking such courses is still comparatively small.

XI. COMMERCIAL EDUCATION

59. Commercial education is under the jurisdiction of the Ministry of Education and is similar in pattern to technical education. The Council for the Education of Assistants in Commerce and Offices has a function parallel to that of the Technical Schools' Council and the "Apprenticeship Board" (para. 13, ii).

60. Four types of commercial courses are at present available: basic commercial, intermediate, advanced or gymnasium, and higher; they may be considered as corresponding to the four levels of technical courses (craftsmen, lower-level technician, teknikum engineer and university engineer respectively).

61. A characteristic feature of basic commercial training in Denmark is the principle of concurrent theoretical and practical training under a "master" (a sort a apprenticeship) and the provision of theoretical education in the so-called "Commercial Schools" owned and run by commercial associations in the larger towns; 46,000 students (27,000 girls and 19,000 boys)attend 175 schools of this type. Candidates with at least eight years' general education are accepted for these courses. A trainee who has completed his period of practical training (from 2 1/2 to 4 years) and has passed his examinations at a commercial school, is a fully trained "Assistant" and receives a certificate to that effect. The government grants up to 52 per cent of the running costs incurred by Commercial Schools, and local authorities cover a further 30 per cent of this amount and insure uniform standards of education by inspection, supervising the setting of uniform examination papers, and by providing officially appointed external examiners.

62. Twenty-four Business Colleges accept students for the Intermediate Commercial Courses leading to a diploma in general and business economics and languages. These courses are a continuation of the basic course; they also help to prepare students who have no apprenticeship training for posts as junior clerks in commerce and business.

63. Advanced courses are held by Advanced Business Colleges and Commercial gymnasia. Admission requirements, which are under revision, are

at present the Middle Commercial Examination diploma or the Real Examination certificate. The courses last from one to two years and lead to the Advanced Commercial Examinations Certificate of a fairly high level, and comprising papers in 15 subjects: Danish, mathematics, bookkeeping, office methods, typewriting, commercial law, general economics, social sciences and statistics, business economics, history, history of commerce, commercial geography, English, German and French.

64. The Schools of Commercial Sciences at Copenhagen and Aarhus are institutes of higher education and research similar to university colleges. They provide higher courses and training in languages for commercial subjects, and general or specific branches of business economics. Day and evening courses are available normally lasting three and four years respectively. The courses are open to those possessing an advanced commercial examination certificate or a Studenter Examen certificate. As from 1966, courses leading to degrees in commercial sciences and commercial languages are being added.

XII. AGRICULTURAL EDUCATION

65. Agricultural education at upper technician and university levels is provided by the "Royal Agricultural and Veterinary College" in Copenhagen, while training at craftsman level is carried out at agricultural schools. The college is under the Ministry of Agriculture and the schools under the Ministry of Education.

66. At present there are 30 agricultural schools with a total enrolment of approximately 3,000 pupils. They are state-aided, residential schools without examinations, organised along the same lines as the Folk High Schools (paragraph 57, i) and attended chiefly by young people brought up in the country. They place special emphasis on practical subjects and applied research in farming. Courses usually last from five to six months, but some schools extend the period by three or four months as preparation for the Agricultural College, which receives a yearly quota of students from these schools, thus ensuring a close connection between the Agricultural College and the farming population.

67. Agricultural Technician courses at the college last for 3 1/2 years and pay particular attention to practical application. Candidates should have had three years training in practical farming and have attended an agricultural school for nine months. A knowledge of mathematics and Danish at primary school level and ability to read an agricultural text in German or English are required.

These entry requirements are now being revised, however, by the educational and agricultural authorities.

68. The college also arranges special post-graduate courses lasting four terms and comprising one main and at least two subsidiary subjects leading to a "lic. Agro." (licentiatus agronomiiae) degree, which compares favourably with diplomas and degrees granted by agricultural universities in other European countries. Graduates of these courses (4 - 5 each year out of 80 - 90 completing the technician courses) find employment chiefly in teaching and research.

XIII. HOTEL AND CATERING TRAINING

69. Hotel and catering courses are part of the apprenticeship scheme and are held only for the lower level (craftsman).

Opportunities for training in home economics and needlework for girls (aged 14 - 18 who have left school) and adults are provided by Evening, Continuation, and Folk High Schools, as well as special schools. (Approved home economics schools and home dress-making schools).

Part Three

FUNCTIONS OF TECHNICIANS

XIV. TECHNICIANS AND THEIR OCCUPATIONS

70. Teknikum engineers enjoy a high reputation in industry and trade. Their status and salary in private industry depend mainly on the nature of the duties they are assigned. They are often found on company boards of directors or in charge of departments. In the civil service they are employed by technical departments, administrative services and in education. A considerable number have either set up in business or as independant consultants.

71. The present Teknikum engineer force is estimated at 13,000, including those who have retired, who are studying, serving in the Army, working abroad, etc. This exceeds by some 3,000 the University engineer force, which previously (1956) was slightly higher. The "active" Teknikum engineer force in Denmark is estimated at about 11,000 as against 8,500 University engineers, distributed as indicated in Tables 15, 16 and 17 (see para. 90).

72. Lower level technicians are found in several branches of private industry and the civil service, and a number of them have their own businesses. Their main functions may be classified as follows: (i) construction, development and research, (ii) production and

maintenance, (iii) quality control, testing and measuring, (iv) administration, sales, etc. Lower level technicians are not yet generally recognised as a separate group of skilled manpower, the main reason being that most of the training courses at this level started only recently (only construction and ship-building courses existed prior to 1956) and good craftsmen with practical experience are often acting as lower level technicians.

73. The total lower technician force does not at present exceed 14,000 (including craftsmen acting as technicians) according to the 1959 statistical data, plus those who have since graduated. This number, compared with that for Teknikum engineers (13,000) and University engineers (10,000), appears to be low. However, the annual increase in lower-level technician courses is much higher than that for Teknikum engineering and University engineering courses.

XV. PROFESSIONAL ORGANISATIONS OF TECHNICIANS
- STATUS AND SALARIES -

74. Teknikum engineers are organised in a professional association, the Society of Engineers, which comprises at present approximately 13,000 members. A second organisation called the Technical Association (approximately 6,000 members) covers the lower technician force with the exception of laboratory technicians, most of whom belong to a separate trade union within the Congress of Trade Unions. The Technical Association is one unit of a congress of eight similar organisations covering different industrial fields such as the Foremens' Association, the Textile Masters' Association, etc. Approximately ten per cent of the members of the Technical Association are Teknikum engineers who are also members of the Society of Engineers.

Both "Civil" and "Academy" University engineers are organised in a common association, the Association of Danish Technologists.

75. The Society of Engineers and the Association of Danish Technologists are both actively engaged in educational and scientific activities

and are represented on a number of consultative and administrative bodies at national level.

76. The Society of Engineers has a written agreement with the government regulating salary scales, pensions, etc. for higher technicians employed in the civil service, and special provisions are in force for those employed in education (paragraph 43). Private industry is not covered by these agreements. The Association, however, issues annual statistics concerning the income of its members employed in private industry and which serve as a guide to those concerned. As a general rule, the average income of Teknikum engineers in private industry is higher than that obtained in the civil service and does not differ substantially from that of University engineers employed in parallel fields, as shown by the statistical data available, summarised in Table 2 (page 43). The average income of lower-level technicians is given in Table 3 (page 44).

77. Possibilities are limited for promotion by means of further study for the lower level technician to Teknikum engineer and University engineer. The provision made for Teknikum engineers to be accepted in the D.T.H. (paragraph 28) is rarely made use of and is considered difficult to apply. On the other hand, there are ample possibilities for competent lower-level technicians to be promoted to supervisory posts or similar leading assignments (paragraph 53).

XVI. AN INDUSTRIAL SURVEY

78. A survey on the functions of technicians in industry carried out by O.E.C.D. in 1964 (Document DAS/ST/64.39, Part II) revealed that some industries are not yet aware of the training facilities which exist for lower-level technicians and do not differentiate clearly between these and craftsmen.

The survey, however, covered only part of three branches of industry, namely, the electronic measuring instrument industry (3 firms), electricity production and distribution (4 firms) and the machine

tool industry (4 firms) occupying a total of fewer than 500 technicians, which is far too low a proportion of the total from which to draw any kind of valid general conclusion. Some of the findings of the survey are summarised in Table 4, and are discussed below.

79. The Technician force in the firm examined makes up 8.6 per cent of the total number of employees.

The educational background of technicians varies from seven to ten (very rarely 12) years of basic education. The technical background is mostly apprenticeship, supplemented by short courses. Only 50 per cent of those interviewed (46) had proper technician qualifications; this percentage would be still lower if calculated on the basis of the total number of technicians employed by the firms examined.
All firms desire personnel with better qualifications, that is, at least eight to ten years of basic education and, in the majority of cases, followed by proper technician training.

Table 2

Average annual income of Teknikum Engineers and University Engineers

(Round figures in Danish Crowns/1,000 [1])

Years of Service	Teknikum Engineers				University Engineers			
	Private Industry		Public Services		Private Industry		Public Services	
	a	b	c	d	a	b	c	d
1	23.9	25.8	21.6	Not available at present			23.4	27.1
2	26.4	27.4	22.1		25.9	29.3	25.1	31.3
4	30.4	30.5	24.9		29.1	34.0	28.4	34.9
6	34.0	34.0	26.6		33.1	38.4	31.5	38.4
8	36.4	36.8	28.1		36.1	43.8	34.3	41.8
10	39.3	39.6	25.7		39.5	48.4	37.0	45.4
12	41.9	42.4	31.4		41.6	52.4	39.7	49.1
14	44.5	44.9	33.0		45.8	58.0	54.4	52.5
16	46.9	47.2	34.6		48.3	65.0	44.2	54.4
18	49.1	49.5	37.0		49.2	66.3	44.2	54.4
20	51.5	51.5	37.0		51.6	69.8	47.9	56.5
22	53.1	53.4	39.7		51.6	74.1	47.9	56.5
24	54.8	55.0	39.7		51.6	70.0	47.9	56.5
Average 1-24	41.0	41.4	30.1		41.9	54.1	38.9	46.0

(a) Average normal salary (1963 Survey)

(b) Average total income including additional salary for administration duties, bonuses, etc. (1963 Survey).

(c) Salary scales covering basic salary + cost of living allowance (October 1964)

(d) Revised salary scales covering basic salary + cost of living allowance (March 1965)

In Public Services, there are also many cases of higher earnings because of special duties (b.above) but data are insufficient for drawing any valid general conclusion.

It should be noted that : (i) normal salaries in private industry (a) are approximately the same for Teknikum engineers and University Engineers, but average total income (b) is much higher for University Engineers : (ii) revised salary scales (d) are (for University Engineers) higher than the respective "normal" salaries in private industry.

Source :"Society of Engineers"and Assoc. of Danish Technologists.

(1) 6.80 Danish Crowns = 1 U.S.A. dollar

Table 3

Average annual income of
lower-level technicians, October, 1964

(Round figures in Danish Crowns/1,000)(1)

Years of Service	Building Constructor		Technician Mechanical Indus.		Draughtsman		Average, all specialities	
	a	b	a	b	a	b	a	b
1	24.8	21.8	20.9	20.9	17.2	15.6	22.0	20.4
2	25.3	23.7	21.9	22.1	17.9	16.3	22.7	21.5
4	26.5	25.6	24.0	23.1	19.1	17.7	23.7	22.7
6	27.5	26.5	25.9	24.3	20.3	18.5	24.7	23.8
8	28.5	27.4	25.9	25.4	21.5	19.8	25.7	24.9
10	29.5	28.5	25.9	25.4	22.6	20.8	26.7	25.6
12	30.4	29.4	25.9	26.5	23.6	21.9	27.7	26.7
14	31.3	30.3	25.9	27.6	24.6	21.9	28.5	27.1
16	32.2	30.3	25.9	27.6	25.6	23.1	29.3	27.5
18	33.0	31.3	25.9	27.6	26.5	24.2	30.3	27.8
20	33.7	32.5	25.9	27.6	27.3	25.3	30.9	28.1
22	34.4	32.5	25.9	27.6	28.1	26.4	31.5	28.2
24	35.0	32.5	25.9	27.6	28.8	26.4	32.1	28.2

(a) Average salary for technicians in private industry.

(b) Salary scales (including cost of living allowance) for technicians in Public Services (State-Association agreement).

Source : "Technical Association"

(1) 6.80 Danish Crowns - 1 U.S. dollar.

Table 4

Breakdown of Technicians in selected industries according to their functions

(Survey DAS/ST/64.39.II)

Functions	A	B	C	Total
1. Construction, development and research	40	117	6	163
2. Production, maintenance	58	79	6	143
3. Quality control, testing and measuring	74	35	2	111
4. Administration, sales, etc.	18	-	2	20
Total technicians	190	231	16	437
Total university engineers	105	77	22	204
Total craftsmen	337	-	300	-
Total employees	1,350	2,930	700	5,050

A : Electronic measuring instruments - 3 firms.

B : Electricity production and distribution - 4 firms.

C : Machine tool industry - 3 firms.

Part Four

GENERAL INFORMATION - STATISTICAL DATA

XVII. THE FINANCIAL SITUATION

Expenditure on education

80. Public expenditure (State and Local Government) on education amounted to D.C. 3,691 million (1) in 1965/66. This corresponds roughly to 5.5 per cent of the Gross Domestic Product at Factor Cost. The estimated national budget for the fiscal years 1965/66 and 1967/68 is given in Table 5.

81. Expenditure on technical education at secondary level is about 6 per cent of the total expenditure for education, distributed by type of school as indicated in Table 6.

82. Actual figures and estimates for building expenditure connected with education, training and research for a number of years (1956/1980) are analysed in Table 7. It will be noticed that a substantial amount (15 to 35 per cent of the total) is devoted to buildings for technical, commercial and agricultural education.

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(1) 6.80 Danish Crowns = 1 U.S. Dollar.

Table 5

National Investment Budget for the financial years 1965/66, 1967/68

Field	1965/66		1967/68	
	In million crowns	Percentage of total	In million crowns	Percentage of total
1. Education	564	13	748	15
2. Communication . . .	1,530	35	1,765	36
3. National health and social security . .	387	9	465	9
4. Army	317	8	315	7
5. Miscellaneous . . .	1,530	35	1,630	33
Total	4,328	100	4,923	100

Source: Extract from "Programme of Public Investments 1966/67 - 1969/70". December 1965.

Table 6

Net government expenditure on technical schools and boarding schools for apprentices

In thousand crowns

	1965/66	1966/67
Net operational expenditure		
1. Technical schools	64,459	83,149
2. Boarding schools for apprentices, hostels, etc.	4,886	9,895
3. Technical colleges (Teknika) . . .	41,386	52,618
Net initial expenditure		
4. Equipment and loans for technical and commercial schools	43,000	9,500
5. Boarding schools for apprentices, hostels, etc.	9,000	9,500
6. Equipment and loans for technical colleges (Teknika)	9,000	12,000
(a) Total net operational expenditure (1-3)	110,731	145,662
(b) Total net government expenditure on education	1,977,448	2,413,881
(c) (a) as a percentage of (b)	6 %	6 %

Table 7

Building expenditure connected with education, training and research, 1956-1980

In million crowns

Field	1956/60	1961/65	1966/70	1971/80	1961/80
1. Commercial and technical schools	20	100	150	250	500
2. Technical University of Denmark and Academy of Engineers	5	200	300	-	500
3. Technical colleges (Teknika)	10	30	50	-	80
4. Royal Veterinary and Agricultural College	-	25	75	50	150
5. Schools of Economics and Business Administration	-	10	-	-	10
6. Hostels (mainly for apprentices)	-	100	125	-	225
(a) Total, technical commercial and agricultural education	35	465	700	300	1,465
(b) Total, other education and research institutions . .	965	1,580	1,700	1,650	4,930
(c) Total, education	1,000	2,045	2,400	1,950	6,395
(d) (a) above as a percentage of (c) (in round figures)	3,5 %	23 %	29 %	15 %	23 %

For 1956/60 the actual expenditure is given in round figures; for 1961/80 the estimated expenditure at 1961 prices. The table was published in a more analytical form in the OECD "Country Review of Denmark", 1962.

XVIII. EDUCATIONAL STATISTICS

83. Tables 8 to 14 attempt to give a quantitative picture of technical education within the framework of general education. Data used were mainly based on information provided by the Directorate of Technical, Commercial, and Marine Engineer Education, and the Statistical Division of the Ministry of Education. These were cross-checked with data available from other sources (reports and other publications), but in case of disagreement the data provided by the Ministry have been used.

84. In 1963/64, 6 per cent of total enrolments in secondary education were in full-time technical courses, and 30 per cent in apprenticeship courses, while at the higher level nearly 19 per cent of the total university population were enrolled at the Technical University of Denmark (D.T.H.) and the Engineering Academy (Table 8).

85. The number of schools holding lower level technician courses increased considerably during the period 1960/64 (Table 9), while that of the schools holding apprenticeship courses dropped from 210 in 1960 to 90 in 1964 (paragraph 49).

86. During the same period the output of lower-level technician courses showed an increase of over 200 per cent (Tables 10, 11) as against 42 per cent for gymnasium courses, and 24 per cent for apprenticeship courses. In 1964, the ratio of University Engineer/Teknikum Engineer was 1:2.2, while for each graduate of a technical school (lower-level technician) there were 4.6 Gymnasia graduates and 15.2 "Real" school graduates.

87. In 1971, the output of technical courses at university level is expected to rise to 669 and that at Teknikum engineering level to 1055, distributed by field of specialisation as indicated in Table 12. The ratio University Engineer/Teknikum Engineer for that year will thus be 1:1.6.

Tableau 8

Breakdown of students by course

Course	School year			Percent. for 1963/64
	1961/62	1962/63	1963/64	
1. Primary level				
Common school (age group 7-14)	566,000	540,000	520,666	
2. Secondary level	214,945	227,584	233,010	100 %
(i) Extended primary (age group 14-16)	39,370	41,975	46,456	20 %
(ii) Preparatory technical (age group 14-16)	-	2,725	2,617	1 %
(iii) "Real" (age group 14-17)	81,800	81,800	80,642	35 %
(iv) Gymnasium (age group 16-19)	22,200	23,400	24,099	10 %
(v) Lower-level Technician (main age group 16-22) . .	3,656	4,604	5,861	3 %
(vi) Teknikum Engineering (main age group 21-24) .	3,558	3,861	4,235	2 %
(vii) Apprenticeship	64,361	69,219	69,100	30 %
3. Higher level			17,858	
(i) Technical University of Denmark (D.T.H.)	2,545	2,569	2,557	
(ii) Engineering Academy . . .	579	686	801	
(iii) Other faculties			14,500	

Table 9

Number of schools holding gymnasium or technical courses

(1960-1964)

Type of school	Schools year			
	1960/61	1961/62	1962/63	1963/64
1. Gymnasia		86	88	89
2. Technical schools (with lower level technician courses)	26	24	30	33
3. Technical colleges (Teknika)	6	6	7	8
4. Technical schools (running apprenticeship courses)	210	121	116	90

In most cases technical schools with lower technician courses also h ld apprenticeship courses.

Table 10

Output of geenral, secondary technical, and vocational courses

(1960-1964)

Course	School year			
	1960/61	1961/62	1962/63	1963/64
1. "Real"	-	-	24,162	22,419
2. "Gymnasium"	4,800	5,400	6,112	6,807
3. Lower-level technician (Technical schools)	447	675	1,072	1,475
4. Teknikum Engineering (Teknika)	803	877	849	891
Total technician (3+4)	1,250	1,552	1,921	2,366
5. Technical University of Denmark (D.T.H.)	-	353	335	326
6. Engineering Academy	-	91	89	82
Total University (5+6)	-	444	424	408
7. Apprenticeship	12,500	13,000	14,500	15,500

Table 11

Output of lower-level technician courses by trade

(1963/64)

Course	Output
1. Laboratory assistants	366
2. Laboratory technicians	34
3. Technicians in chemical industry	15
4. Technical assistants (Calculators, Draughtsmen, Light Engineering)	319
5. Technicians in electronics	32
6. Technicians in mechanical industry	137
7. Building technicians	260
8. Building constructors	206
9. Furniture constructors	13
10. Gold and silver craft designers	8
11. Dress designers	34
12. Textile (Weaving and Printing) technicians	14
13. Graphic arts technicians (commercial advertisement)	22
14. Ceramic industry technicians	15

A course for clothing-industry technicians started experimentally in 1963 with 15 students.

Marine engineering courses have not been included here.

XIX. POPULATION AND MANPOWER STATISTICS

88. Tables 13 to 19 summarise available statistical data on manpower distribution and projection. The figures used were mainly based on data contained in the 1959 "Technical Commission" report, the 1960 census

Table 12

Estimated output of Teknikum Engineering (I) and University Technical (II) courses. 1961/71

	1961		1966		1971	
	I	II	I	II	I	II
1. Civil Engineering:						
Public Works	149	110	195	125	240	139
Building	160	-	227	-	292	-
2. Mechanical engineering. .	146	114	202	137	255	162
3. Electrical engineering. .	152	118	210	153	268	191
4. Chemical engineering. . .	-	120	-	148	-	177
Total	607	462	834	563	1,055	669

Source: Ministry of Education and Science.

and on material provided by the "Society of Engineers" and the "Association of Danish Technologists.

89. The active population in Denmark reached nearly 44 per cent of the total population in 1960, distributed by occupation and post as indicated in Tables 13 and 14.

90. In 1964, the active Teknikum engineer force in Denmark was approximately 11,000. A survey carried out by the "Society of Engineers and published in 1964 gave the results reproduced in Tables 15 and 16 as regards the distribution of Teknikum Engineers. The survey extended to approximately 70 per cent of the membership but valid data gathered covered only 51 per cent (about 61 per cent of the active force). However, they are the only reliable up-to-date figures available. Further analysis, and similar data for the University engineers, are given in Tables 17 and 18, while information available on future requirements of technical manpower is summarised in Table 19.

Table 13

Breakdown of employed persons (1960 census)
by occupation and post

(Gainfully employed in trade or industry)

	Men	Women	Total
1. Self-employed persons	383,300	45,600	428,900
2. Wives assisting husbands		45,200	45,200
3. Employees, of whom:	310,100	253,400	563,500
(a) Senior and subordinate office staff, book-keepers, cashiers, etc.	72,400	110,300	182,700
(b) Senior and subordinate shop assistants	68,100	51,000	119,100
(c) Architects, engineers	18,600	400	19,000
(d) Shop foremen, foremen, stewards	18,900	1,700	20,600
(e) Laboratory workers, draughtsmen, decorators	7,300	6,600	13,900
4. Skilled workers	283,100	18,300	301,400
5. Non-skilled workers	470,500	197,700	668,600
Total active population	1,447,400	560,200	2,007,600
Total population	2,274,700	2,310,556	4,585,256

Table 14

Breakdown of technical personnel (1960 census)
by professional category

	Men	Women	Total
1. Architect, clerk of works, housing adviser	3,700	200	3,900
2. Teknikum engineer, university engineer, builder	14,900	200	15,100
3. Pharmacist and other fields of scientific technical training	1,500	800	2,300
4. Shop foreman, foreman, steward . . .	18,900	1,700	20,600
5. Laboratory writer, draftsman, decorator	7,300	6,600	13,900
6. Punched-card and engineroom staff . .	500	400	900
7. Marine engineer, assistant engineer on land	2,800	-	2,800
8. Captain, shipmaster, mate	3,700	-	3,700
9. Radio-operator, chief engineer, assistant engineer at sea	4,800	-	4,800
Total	58,100	9,900	68,000

Table 15

Breakdown of Teknikum Engineers by service (1964)

Service	Number	Distribution %
1. Self employed	315	4.7
2. In private firms	4,950	73.5
3. In semi-public firms	313	4.6
4. In civil service	977	14.5
5. In other services	182	2.7
Total	6,737	100.0
Non-classified	6,300 approximately	

Table 16

Breakdown of Teknikum Engineers in private industry by industrial fields

Field	Number	Distribution %
1. Mechanical engineering	2,174	43.9
2. Production engineering	369	7.5
3. Shipbuilding engineering	91	1.8
4. Electronics	395	7.9
5. Electrical engineering	623	12.6
6. Civil engineering	666	13.5
7. Construction engineering	632	12.8
Total	4,950	100.0

Table 17

Breakdown of University Engineers and Teknikum Engineers
by field of economic activity

Field	1956			1960		
	I	II	I+II	I	II	I+II
Industry						
1. Wood				187	82	269
2. Textile				26	23	49
3. Shoe and clothing . . .				4	22	26
4. Wood				18	43	61
5. Paper				83	76	159
6. Chemical				429	166	595
7. Stone, cement, porcelain, glass, etc.				166	105	271
8. Iron and other metals .				880	2,653	3,533
9. Transport machinery . .				203	410	613
10. Other industry				43	26	69
(a) Total industry	1,826	2,998	4,824	2,039	3,606	5,645
11. Building	963	1,061	2,024	1,229	1,733	2,962
12. Commerce	318	267	585	198	301	499
13. Transport	402	175	577	277	242	519
14. Public services	1,367	809	2,176	551	968	2,519
15. Education and research .	352	73	425	551	213	764
16. Self-employed				444	449	893
17. Other business	117	53	170	115	67	182
(b) Total 11 to 17	3;519	2,438	5,957	4,365	3,973	8,338
Total employed in Denmark (1 to 17)	5,345	5,436	10,781	6,404	7,579	13,983

Table 17 (continued)

Field	1956			1960		
	I	II	I+II	I	II	I+II
18. Employed in Danish Islands				8	9	17
19. Employed abroad in Danish firms				221	167	388
20. Employed abroad in foreign firms				667	323	990
(c) Total employed outside Denmark (18 to 20) . . .	856	548	1,404	896	499	1,395
(d) Total employed (1 to 20)	6,201	5,984	12,185	7,310	7,579	14,889
21. In the Army	500	276	776	515	456	971
22. Studying				3	8	11
23. Unemployed				-	13	13
24. On pension				81	85	166
25. Non-identified or out of work (pension, etc., excluding 24)	563	455	1,018	-	-	
(e) Total non-employed (21 to 25)	1,063	731	1,794	599	562	1,161
(f) Grand total (1 to 25) .	7,264	6,715	13,979	7,909	8,640	16,549
Active force in Denmark (d) as a percentage of (f) .	85%	89%	88%	92%	88%	90%

Table 18

Breakdown of University Engineers (I)
and Teknikum Engineers (II) by specialisation, 1960

Field	Active force in Denmark			Working abroad or not working (retired, army, studying, etc.)			Totals		
	I	II	I + II	I	II	I + II	I	II	I + II
1. Mechanical production engineer	1,393	3,576	4,969	352	474	826	1,745	4,050	5,795
2. Electrical engineer .	1,130	1,657	2,787	232	204	436	1,362	1,861	3,223
3. Civil engineer	2,338	1,122	3,460	627	179	806	2,965	1,301	4,266
4. Housebuilding engineer	-	958	958	-	159	159	-	1,117	1,117
5. Chemical engineer . .	1,286	-	1,286	250	-	250	1,536	-	1,536
6. Shipbuilding engineer	-	106	106	-	14	14	-	120	120
7. Non-specified	257	160	417	44	31	75	301	191	492
Total	6,404	7,579	13,983	1,505	1,061	2,566	7,909	8,640	16,549

Table 19

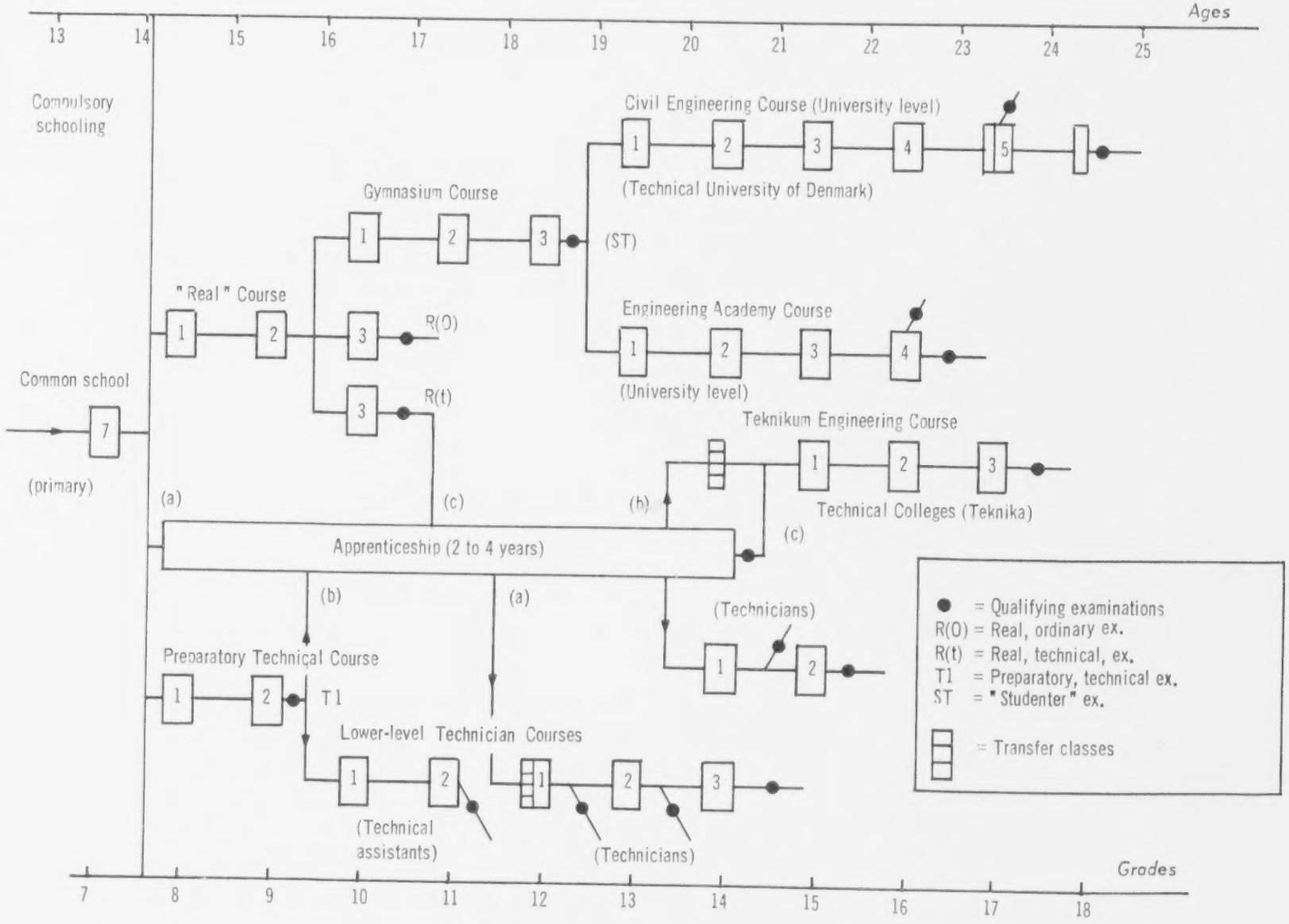
Estimated technical manpower requirements (1956-1971)

Grade	1956	1960	1966 est.	1971 est.	Percent rise 1956/71
1. University engineers . . .	7,800	8,800	10,700	12,600	62 %
2. Teknikum engineers	7,300	8,700	14,600	18,400	152 %
3. Lower-level technicians .	9,600	11,500	17,000	27,500	186 %
Total technicians (2 + 3) . .	16,900	20,200	31,600	45,900	171 %

Figures for 1 and 2 (except for 1960), were published by the "Technical Commission" in 1959. Figures for 3 were based on data available for 1955 and 1959 and thereafter on the estimated annual output of courses.

Appendix I

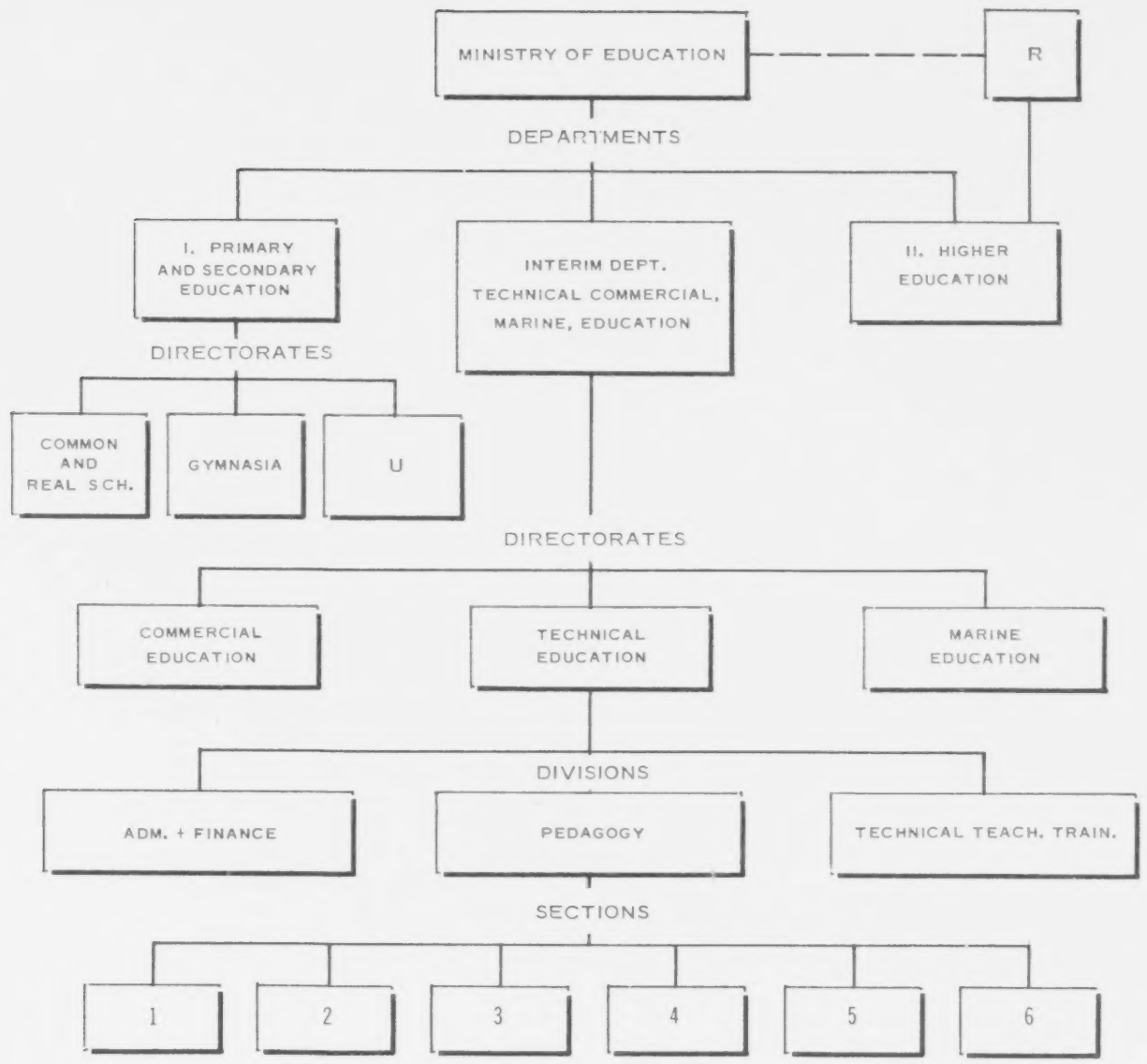
TECHNICAL AND VOCATIONAL COURSES WITHIN THE EDUCATIONAL SYSTEM



Appendix II

MINISTRY OF EDUCATION - ADMINISTRATIVE STRUCTURE

A. STRUCTURE, March 1965



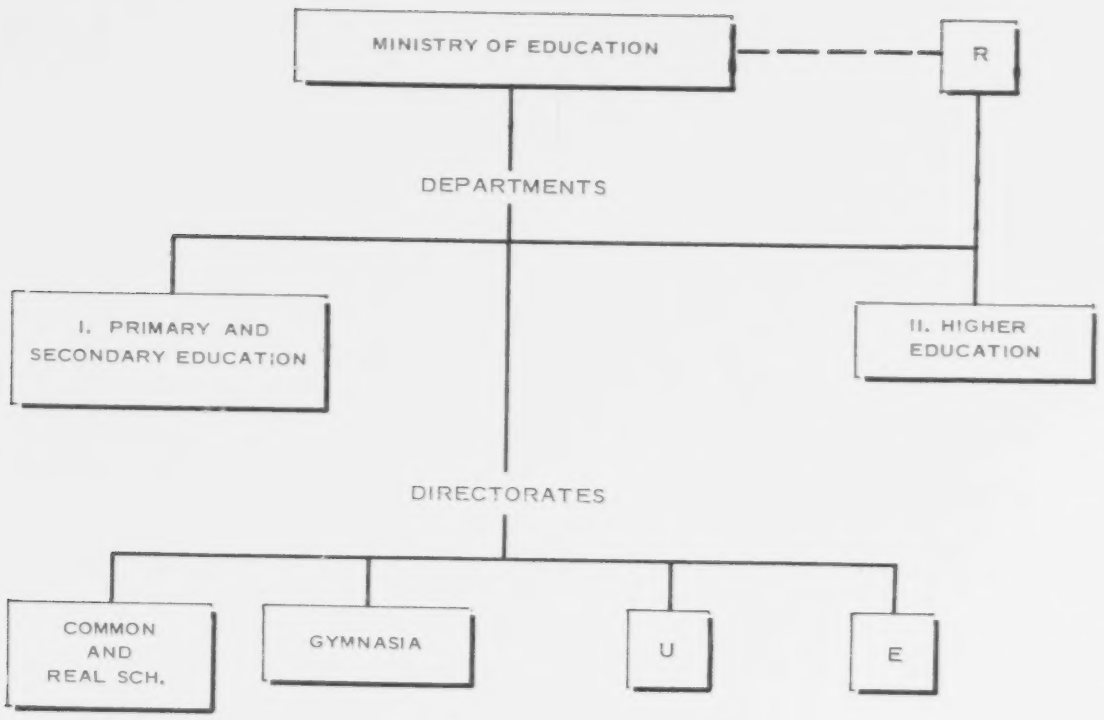
Directorate U : Youth Schools, Lower Agricultural Education, Adult Education, etc.

Section 1 : Apprenticeship
2 : Lower Technical Education
3 : Teknikim Education
4 : Examination
5 : Supervision
6 : External Relations

R = Advisory Council for Higher Education.

(Appendix II)

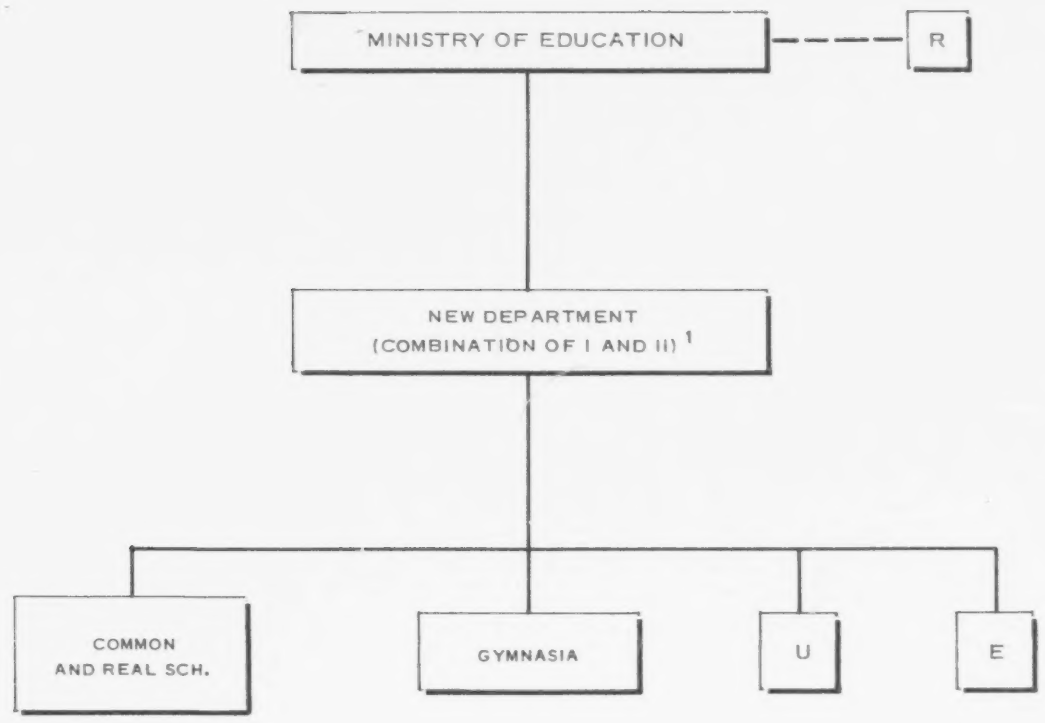
B. STRUCTURE, April 1965



R = Advisory Council for Higher Education.
U = Youth Schools, Lower Agricultural Education, Adult Education, etc.
E = Technical, Commercial and Marine Engineering Education (Former Interim Department).

(Appendix II)

C. STRUCTURE, October 1965



R = Advisory Council for Higher Education.
U = Youth Schools, Lower Agricultural Education, Adult Education, etc.
E = Technical, Commercial and Marine Engineering Education
(Former Interim Department).

1. *Details of the organisational structure within this department are not shown.*

Appendix III

ACT AUTHORIZING

THE COURSE "TECHNICIANS IN THE MECHANICAL ENGINEERING INDUSTRY"

(Main Points)

Ministry of Education, 11th November, 1964

In pursuance of paragraph 2, Act 191 of June 4th, 1964, on the recognition of Vocational Schools, Technical Schools and Engineering Schools, the following are hereby established:

1. Technical Schools may, on the approval of the Ministry of Education, establish a course for the training of technicians for the mechanical engineering industry.

2. The aim of the course is to give the students a technical education qualifying them to work in the mechanical engineering industry either in the construction or the operational field.

At the end of the course, students are expected to take the qualifying examinations for the "Technician in the Mechanical Engineering Industry" certificate.

3. Candidates should possess:

(a) The "Preparatory Technical Examination Certificate" or "Real Examination Certificate" or any other higher qualifications;

(b) Apprenticeship Certificate in one of the following trades: Auto-mechanics; electrical work; electro-mechanics; fine-mechanics; machine tool industry; agricultural machinery-mechanics; machine-shop; weapon-mechanics;

or:

Prove that they have such skill as might be considered equivalent to that acquired through apprenticeship training as above.

In exceptional cases the Committee mentioned under (10) below, may approve admission to the course for students not fulfilling the above conditions.

4. The course may be held:

(a) As a one-year full-time course;

(b) As a part-time evening course;

(c) As a correspondence course, combined with school attendance.

5. For the full-time course, allocation of time should be as follows:

Number of periods in the one-year full-time course

	Part I	Part II	
		Construction field	Operational work
Danish	40	40	40
Mathematics	160	80	80
General physics	80	-	-
Statics	80	-	-
Knowledge of materials . . .	40	40	40
Technology	80	80	80
Control systems	-	40	40
Technical drawing	160	340	120
Machine construction	-	220	120
Electro-mechanics	40	40	40
Operational techniques . . .	120	-	200
Workshop organisation	80	-	120
Total	880	880	880

For the evening and correspondence courses, allocation of time should be approved by the Technical Schools' Council.

Curriculum:

Danish

Writing and study techniques.
Essays - reports - correspondence.

Mathematics

Calculations - use of the slide rule - trigonometry measurements - standards.

General physics

Cinematics - dynamics - heat - work - effect - gauge systems.

Statics

Elementary statics - simple calculations mainly on simple machine elements.

Materials

Iron, steel, cast-iron, plastics - the most important metals and their alloys - lubricants.

Technology

Mechanical and non-mechanical processes, moulding and casting - measuring tools, gauges, allowances.

Control systems

Principles - components - diagrams.

Technical drawing

Technical detail and assembly drawing - symbols - calculations.

Machine construction

Machine elements - typical construction problems, namely machine parts and tools.

Electricity

Direct and alternating currents - electrical machines and their fixtures - electrical control components.

Operational techniques

Work studies - conditions of work - instruction techniques, sytems and calculations.

Workshop organisation

Organisation and running principles, technical book-keeping - instruction - safety rules - law concerning protection of workers.

Extent of tuition and examination requirements for each subject is stipulated by the Ministry of Education.

7. The course may be supplemented by special courses as decided by the Ministry of Education.

8. On the completion of Part I students are required to pass a test and, on the completion of Part II, to take a final examination.

The regulations of the Ministry of Education concerning examinations at approved and subsidised technical schools are valid for the test and the examination mentioned above.

Rules concerning operational matters as well as the date of examinations and tests are fixed by the Technical Schools' Council.

The papers for the test should be prepared by the schools, while the paper for the final examination should be prepared by the examinations' section of the Ministry of Education.

Only those students certified by the school as having completed the year's work are allowed to take the test or examinations.

For correspondence courses the rules laid down by the Technical Schools' Council should be followed.

The examination should take place at technical schools authorised to hold the course. Examiners must be teachers at the school.

The examination should be arranged as follow:

S - written examination;
M - oral examination;
K, A } work during the year.

	Test	Examination
0. Danish	A	S
1. Mathematics	S	S
2. General physics	S	-
3. Statics	S	-
4. Materials	-	M
5. Technology	-	M
6. Control systems	-	A
7. Technical drawing	K	K + S (1)
8. Machine construction	-	K + M (1)
9. Electro mechanics	-	S
10. Operational techniques	M	S (2) + K (2)
11. Workshop organisation	M	M (2) + K (2)

(1) For student majoring in construction work.

(2) For students majoring in operational techniques.

For the written examination the students should be allowed 4 hours for each subject and 6 hours for drawing.

The oral test, evaluation of the year's work and marking of the papers should be carried out by the teacher and one external examiner.

The Ministry of Education appoints officially an examiner. The pass mark for the test is an average of 3 points in each subject (scale 0 - 7).

Only subjects examined in the test are transferred to the Certificate.

No-one is allowed to take the examination more than twice unless special approval is given by the Technical Schools' Council.

All subjects should be taken at the same time.

9. The Leaving Certificate should be in the form approved by the Ministry of Education; it should be issued by the school.

10. The Ministry of Education appoints an Advisory Committee for the Trade composed of representatives of the following bodies:

Iron and metalwork industries (2 members), Union of Blacksmiths

and Machine-shop Workers (2 members), Technicians' Association, Supervisors' Association (1 member jointly).

The Committee elects one of its members as chairman.

The Committee acts in an advisory capacity to the Ministry of Education and to the Technical Schools' Council in all matters concerning the present course.

The Committee is expected to initiate and make recommendations to the Ministry of Education.

11. The board of the school authorized to hold the course should appoint a Local Advisory Committee for the school to advise the school management on matters relating to the course and ensure contact between students and industry during and after completion of the course.

Appendix IV

LOWER-LEVEL TECHNICIAN COURSES

A. Main characteristics

	Admission requirements			Duration of course	Normal age range
	Educational background	Practical training required	Preparatory courses necessary		
1. Laboratory assistant	T1	-	-	6 months	16-17
2. Laboratory technician	Lab. Ass.	1 year	-	20 weeks	17-19
3. Technician in chemical industry	Lab. Ass.	1 year	-	21 weeks	17-19
4. Technical assistant (calculators,/ draughtsmen, engineering assistants)/	a) T1	-		2 years sandwich course	16-18
5. Technician in electronics	T1	Apprentice-ship	-	1 year	20-21
6. Technician in mechanical engineering/ industry/	T1	Apprentice-ship	-	1 year	20-21
7. Building technician	a) 7 years	Apprentice-ship	6 months	2 years	18-21
	b) 9 years education	Apprentice-ship	3 months	2 years	20-23
8. Building constructor	Building	Technician	-	6 months	21-24
9. Furniture constructor	7 years education	Apprentice ship	-	3 years	18-21
10. Technician in textile industry	9 years	-	-	6 months 1 year	17-19
11. Assistant for readymade clothing industry	9 years	-	-	6 months	17-19

(Appendix IV)

B. Selected time-tables

1. Laboratory technician (theory)

Biology		Chemistry	
1. Chemistry	14	Chemistry	21
2. Biochemistry	21	Organic chemistry	70
3. Mathematics	35	Mathematics	35
4. Physics	28	Physics	56
5. Anatomy and physiology	49	--	-
6. Microbiology	49	--	-
7. Laboratory techniques	84	Laboratory techniques	84
8. Technical languages and library	28	Technical languages and library	28
9. Industrial regulations	28	Industrial regulations	28
10. Biology (laboratory work)	364	Chemistry - physics (laboratory work)	364
11. Various	35	Various	49
Total number of lessons	735	Total number of lessons	735

(Appendix IV)

2. Technical Assistants (day courses, theory)

	Class I	Class II		Engineering Assistants
		Calculators	Draughtsmen	
1. Introductory studies and tests	176	-	-	-
2. Technical arithmetic and mathematics	80	48	48	48
3. Technical science	48	-	-	-
4. Theory of measurement and calculations	40	-	-	-
5. Book-keeping	80	72	72	72
6. Technical drawing	284	144	504	144
7. Production techniques . .	104	240	120	456
8. Industrial administration	100	96	96	96
9. Knowledge of materials .	72	-	-	-
10. Theory of machines and tools	72	144	120	144
11. Mechanics	144	144	120	144
12. Industrial calculations .	-	216	-	-
13. Electronics	-	48	48	48
Total number of lessons	1,056	1,056	1,056	1,056

Two-year course consisting of a theoretical six-month course (Class I) followed by one year of practical training and a final six month course (Class II).

3. Technician in the electrical industry (Theory)*

1. Danish, correspondance and civics	120
2. Technical English	40
3. Ordinary and technical reckoning	120
4. Mathematics	200
5. Industrial drawing	120
6. Mechanical construction	120
7. Electricity techniques	160
8. High voltage techniques	240
9. Materials and technology	160
10. Laboratory work and estimating	320
11. Workshop organisation	80
12. Book-keeping, wages, workshop conditions	80
Total number of lessons	1,760

One-year, full-time course

* For technicians in the engineering industries see Appendix III.

(Appendix IV)

4. Furniture construction

	First year	Second year	Third year
1. Trade history	-	108	-
2. Sketching and painting composition .	216	252	342
3. Theory of construction	126	108	-
4. Furniture drawing	468	468	468
5. Measuring	234	234	235
6. Perspective drawing	-	234	126
7. Projection drawing	234	-	-
8. Joints	126	-	-
9. Knowledge of materials	24	-	-
10. Book-keeping and calculation	-	24	-
11. Surfacing	-	-	24
Total number of lessons	1,428	1,428	1,428

Three year, full-time course.

Appendix V

TEKNIKUM ENGINEERING

Selected time-tables

Mechanical engineering, production engineering, shipbuilding engineering, electrical engineering

	First year Common to all the above-mentioned specialities
1. Danish and civics	140
2. German	120
3. English	120
4. Mathematics	240
5. Theory of measurement and calculations .	80
6. Physics	200
7. Chemistry	100
8. Laboratory practice (Physics and chemistry)	120
9. Statics	40
10. Technology	80
11. Book-keeping and basic theory of commerce	60
12. Machine drawing and descriptive geometry	460
Total number of lessons	1,760

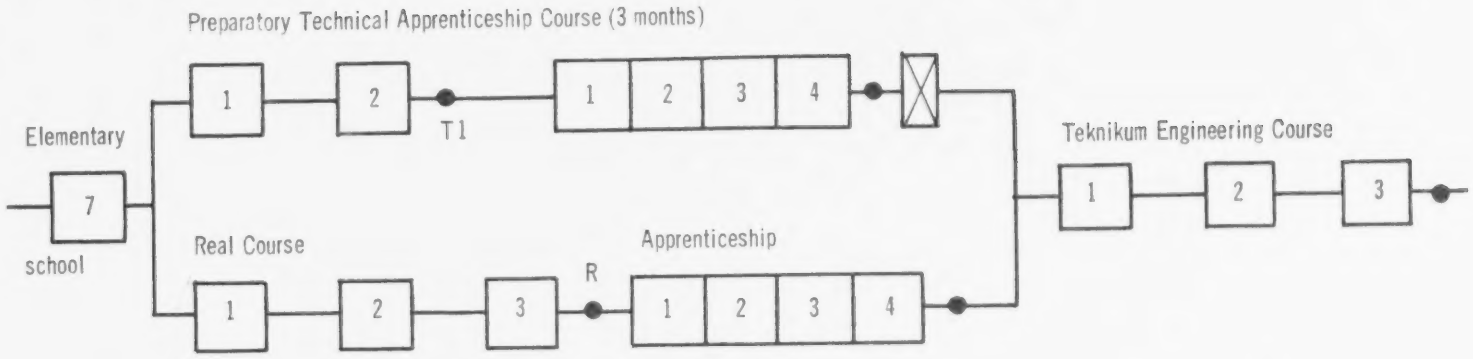
(Appendix V)

	Second year				
	Mechanical engineering	Production engineering	Shipbuilding engineering	Electrical engineering	
				High Power	Low Power
1. Mathematics	200	200	200	200	240
2. Mechanics	320	400	400	360	360
3. Theory of machines and machine/ techniques/	680	480	440	520	320
4. Machine design	860	780	280	-	-
5. Laboratory practice (machines, electro-technics, ship techniques)/	200	200	200	-	-
6. Industrial engineering	480	920	360	-	-
7. Industrial administration and production techniques/	80	80	60	360	360
8. Electrical engineering	280	230	200	2,080	2,240
9. Heating and ventilation	120	120	120	-	-
10. Shipbuilding and ship construction	40	-	1,200	-	-
11. Building design	60	60	60	-	-
12. Optional subjects: (a) Building construction (3 weekly lessons in 1 semester) (b) Surveying (during holidays)					
Total number of lessons	3,520	3,520	3,520	3,520	3,520

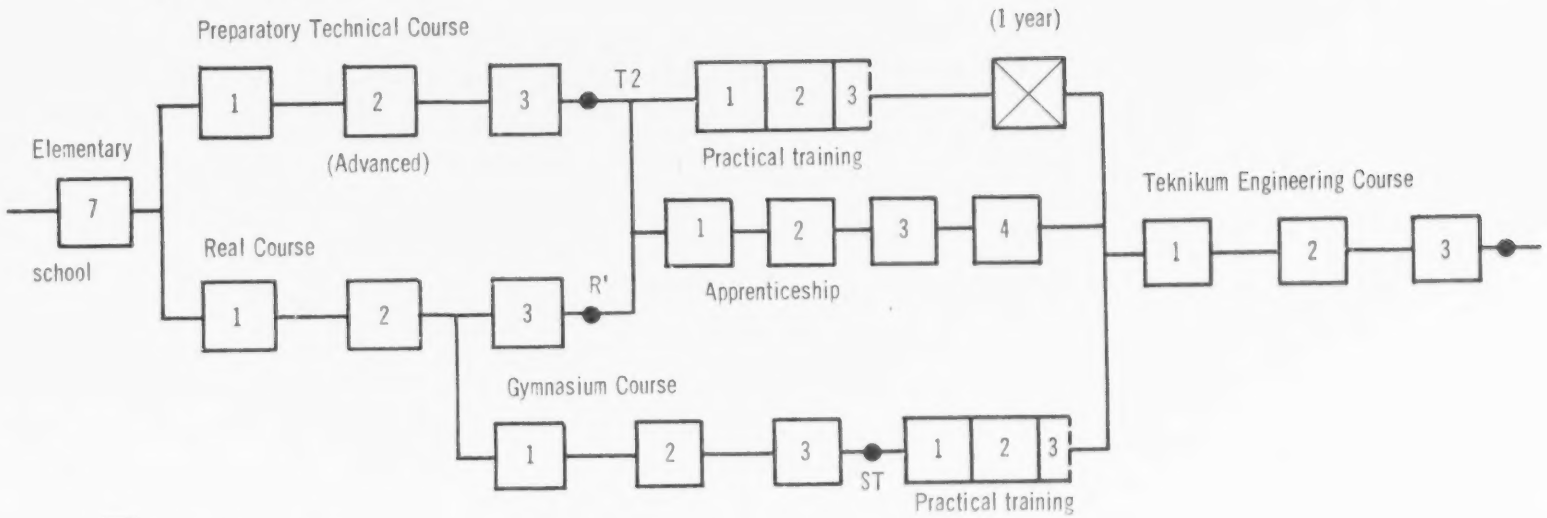
Appendix VI

THE " TEKNIKUM " COURSE

A. PRESENT SITUATION



B. PLANNED CHANGES



Preparatory classes

Qualifying exams.

T1, T2 Preparatory technical

R " Real " with two languages

R' " Real " with maths or technical

ST " Studenter " exams.

96
80

Appendix VII

SELECTED BIBLIOGRAPHY

1. Draft report on the Education and Training of Engineers of non-university level and Technicians in Denmark (OECD through FEANI, EUSEC, DAS/ST/64.39. Part I).

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8. Apprenticeship within Danish Industry and Handicraft. (The Commission of Technical and Vocational Training, Copenhagen 1964)

9. Census of Denmark, 1960.

10. Salary Statistics. (Report of the Association of Danish Technologists, Copenhagen 1964).

11. Salary Statistics. (Report of the Society of Engineers, Copenhagen 1964).

12. Salary Statistics. (Report of the Technical Association, Copenhagen 1964).

Appendix VIII

SELECTED LIST OF

INDIVIDUALS AND ORGANISATIONS CONSULTED

I. Ministry of Education

Mr. Werner Rassmussen, Director and Commissioner, Technical and Vocational Education.
Mr. L. Dahlgarrd, in charge of statistics.
Mr. P. Storch, in charge of examinations.
Mr. V. Thaulow, in charge of Teknikum Engineer education.
Mr. H. Möller-Hansen, in charge of the education of apprentices.
Mr. K.V. Nielsen, in charge of the education of lower technicians.
Mr. H. Scultz-Hansen, in charge of text book production.
Mr. E. Frederiksen, in charge of external relations.
Mr. Bjørn Westh, Deputy Director, Institute of Education of Technical Teachers.

II. Ministry of Labour

Mr. B. Hanson, in charge of education of unskilled workers.
Mr. P. Kirstein, in charge of manpower service.

III. Council of Education of Teknikum Engineers

Mr. Werner Rasmussen, Vice-Chairman.
Mr. H.P. Christiansen, Member.
Mr. Tage Jensen, Member.

IV. Council of Technical Schools (for the Education of Skilled Labour and Lower Technicians)

Mr. Werner Rasmussen, Chairman.
Mr. Tage Jensen, Member.

V. Committee on Training of Teachers for Teknikum Education

Mr. Bjørn Andersen, Secretary.

VI. Technological Institute (Ministry of Commerce and Industry)

Mr. B. Gregersen, School Director.

VII. Employers' Confederation (Dansk Arbeidgiver Forening)

Mr. E. Lund Nielsen, Secretary, Department of Educational Policy.

VIII. Congress of Trade Unions

Mr. Tage Jensen, Secretary.

IX. Federation of Danish Industries

Mr. J.T. Klaumann, in charge of training.

X. Association of Danish Technologists (University Engineers)

Mr. Bjørn Andersen, Secretary General.

XI. Society of Teknikum Engineers

Mr. H.P. Christiansen, Vice-President.

XII. Technical Association (for skilled personnel)

Mr. C. Stenkjaer, Secretary.

Appendix IX

CONFRONTATION MEETING BETWEEN CANADA

AND DENMARK

CONCLUSIONS

A. Delineation of the category of skilled labour force under consideration

1. It was agreed that a "scholastic" definition of the technician should be avoided.The force under consideration was defined as that which lies between the skilled worker at one end and the professional engineer at the other.

2. It was decided that,although discussions should be focussed on engineering technicians as the information available was mainly in this field, technicians in other fields should be also covered as adequately as possible.

B. Level of Technicians - Certification - Training

3. It was agreed that the technician force should be classified into two main levels, provisionally termed the junior or lower technician

level and the senior or upper technician level. The classification should be based not on functional assignments but on educational qualifications which need not necessarily be acquired in a formal way.

4. The titles used to define the various levels of technical personnel vary from country to country. In Denmark lower-level technicians are defined as "technicians" or "technical assistants", and upper-level as "Teknikum Engineers", while in Canada the term "technologist" is used for the upper level and the term "technician" for lower-level. University engineers are defined as "engineers" or "professional engineers" in Canada and "civil engineers" or "academy engineers" in Denmark.

5. Difficulty was experienced in comparing the training programmes of the two countries because of difference in basic principles. The Danish system is based mainly on apprenticeship training while the Canadian is entirely institutional. After discussion, it was agreed that, though apprenticeship should not be a prerequisite for technician training, a period of practical training in industry is essential. The Danish authorities have already realised this fact and are planning to reduce the apprenticeship period preceding technician training.

6. By comparing the "Teknikum Engineer" of Denmark with the "Technologist" of Canada it became evident that Senior Technician training should be a standardised post-secondary training of a less theoretical but more practical character than university-level training in parallel fields.

7. By studying the fields of activity of junior technicians it was agreed that junior-technician training programmes should be flexible in character and duration, and should be specially adapted to the needs of the individual trade in each country. A basic general education of at least 10 years was considered essential to produce an adaptable "end product". This educational background, together with the additional education and training acquired through the course proper, should bring the junior technician to an educational level comparable with that of a full secondary education. Specific training programmes were further discussed on the basis of illustrated lecture (projection of slides) by the Danish Delegation.

8. Standardised certification, already well ahead in Denmark, was considered essential not only at national level but also internationally. OECD was invited to assist Member countries in this respect.

C. Vocational Guidance Service - Wastage from technical courses

9. Study of relevant information revealed that vocational guidance services in both countries are not properly organised. It was decided that further steps should be taken to establish effective services in both vocational guidance and vocational selection fields.

10. Wastage from Senior Technician and University courses was shown to be a major problem, particularly in Canada. Many factors appear to influence this wastage including the inadequacy of vocational guidance and selection.

It was decided that further investigation should be undertaken to find out (i) the reasons for high wastage, (ii) what happens to the "drop-outs".

D. Recruitment and training of technical teachers

11. In both countries the recruitment of technical teachers presents difficulties because of the scarcity of properly qualified personnel and composition from industry.

12. It was agreed that a technical teacher should:

(i) Possess qualifications ensuring a thorough theoretical and practical knowledge of the subject he is expected to teach;

(ii) Have industrial experience in appropriate fields;

(iii) Be familiar with basic educational principles and possess adequate knowledge of teaching methods and techniques;

(iv) Be kept continuously aware of new developments in educational and industrial fields.

The ensuring of this was agreed to be an important area where further governmental action was necessary. OECD was invited to assist the countries in this field.

13. The possibility of securing the part-time services of personnel from industry was discussed. It was agreed that this procedure, though difficult to put into practice at least so far as day courses were concerned, should be further explored; it would, in fact, encourage the the person concerned to keep continuously up-to-date in both the theoretical and practical fields.

14. Further discussion led to the conclusion that a reciprocal flow from industry to education and vice-versa is highly desirable. To ensure this, the establishment of rules for the recognition of a "continuity of service" (years of service, pension, etc.) would be necessary. In Denmark this problem is being tackled by the technicians' professional association.

15. Discussion of the status and salaries of technical teachers revealed that the authorities in charge should be advised to set up salary scales, pension allowances, etc., comparable to those offered by industry.

E. Authorities in charge of technical and vocational education - Coordination of effort

16. Provincial autonomy in Canada creates a special situation and makes comparison with Denmark or other European countries difficult. Discussion led to the conclusion that although decentralisation is for several reasons advisable, the existence of a central co-ordinating authority is indispensable to ensure the requirements of a sound educational policy at national level and the desirable standardisation of qualifications as a pre-requisite for internal mobility.

F. Status of technicians and their careers

17. An examination of the information available led to the conclusion that, in both countries, two types of technicians exist at present, namely:

(i) Those classified as technicians by virtue of their educational qualifications.

(ii) Those who, because of their long experience and aptitude, perform the duties of technicians, regardless of their formal qualifications.

In both countries, however the latter category was created to meet the urgent requirements of rapid industrial expansion with which the provision of educational facilities could not keep pace; this category is gradually disappearing in both countries.

18. Discussion on the organisation and functions of technicians' professional associations led to the conclusion that such associations should be encouraged as they greatly contribute to the social recognition of the professional status of this category of skilled personnel. The successful example for Denmark should encourage other countries to take the same direction.

19. Discussion on the earnings of technicians in industry revealed that these depend largely on the personnel ability of the individual, and, in some cases, are higher than those of professional engineers.

20. The limited possibilities available in the two countries for promotion (by up-grading) from skilled worker through junior technician to senior technician and university engineer was shown to be a feature of the present situation. Though such promotion should be encouraged, it should always be kept in mind that training for each skilled category is an entity in itself and cannot be regarded as part of another; consequently the distortion of training programmes to facilitate continuity and transferability should be avoided.

G. Availability of statistical data

21. In both countries the availability of statistical data enabling the planning and implementation of technician training programmes is either inadequate or inexistent. It was decided that an effort should be made to secure such data based mainly on the real needs of industry rather than on the available capacity of the educational establishments. It was made clear however that one of the main difficulties in estimating the needs of industry for skilled man-power was industry's hesitation to make any firm statement as regards future needs; Research and Development Services were considered to be more reliable sources for such information.

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